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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/761,217	01/16/2001	Shailender Chaudlhry	SUN-P3900-SPL	4812

				EXAMINER
22835	7590	09/22/2004		O'BRIEN, BARRY J

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ART UNIT	PAPER NUMBER
2183	

DATE MAILED: 09/22/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)
	09/761,217	CHAUDLHRY ET AL.
	Examiner	Art Unit
	Barry J. O'Brien	2183

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE _3_ MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.
- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on _29 July 2004_.

2a)☐ This action is **FINAL**.   2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) _1-9,12-20,23 and 24_ is/are pending in the application.

    4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) _1-9,12-20,23 and 24_ is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

    Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

    Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

    a)☐ All   b)☐ Some * c)☐ None of:

      1.☐ Certified copies of the priority documents have been received.

      2.☐ Certified copies of the priority documents have been received in Application No. _____.

      3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

    * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1)☐ Notice of References Cited (PTO-892)

2)☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3)☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
    Paper No(s)/Mail Date _____.

4)☒ Interview Summary (PTO-413)
    Paper No(s)/Mail Date. _20040914_ .

5)☐ Notice of Informal Patent Application (PTO-152)

6)☐ Other: _____.

DETAILED ACTION

1.   Claims 1-9, 12-20 and 23-24 have been examined.

Papers Submitted

2.   It is hereby acknowledged that the following papers have been received and placed on

record in the file: RCE as received on 7/29/04 and Extension of Time as received on 7/29/04.

Specification

3.   The lengthy specification has not been checked to the extent necessary to determine the

presence of all possible minor errors. Applicant's cooperation is requested in correcting any

errors of which applicant may become aware in the specification.

4.   The applicant is requested to review the specification and update the status of all co-

pending applications made mention of, replacing attorney docket numbers with current U.S.

application or patent numbers when appropriate.

Claim Rejections - 35 USC § 102

5.   The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the

basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

6.   Claims 1-9, 12-20 and 23-24 are rejected under 35 U.S.C. 102(b) as being anticipated by

Marcuello et al., *Value Prediction for Speculative Multithreaded Architectures* (hereinafter

Marcuello(1)), and further by Marcuello et al., *Speculative Multithreaded Processors*

(hereinafter Marcuello(2)), incorporated by reference in Section 2 of Marcuello(1).

7.   Regarding claims 1, 12 and 23, taking claim 12 as exemplary, Marcuello has taught an

apparatus that facilitates predicting a result produced by a section of code in order to support

speculative program execution, the section of code including a plurality of program instructions

(see Marcuello(2) Col.1 lines 11-16 and Col.2 line 47 – Col.3 line 9), the apparatus comprising:

a.   A head thread that is configured to execute the section of code within a program,

wherein executing the section of code produces the result (see Marcuello(2) Col.5

lines 19-25),

b.   A prediction mechanism that is configured to generate a predicted result to be

used in place of the result before the head thread produces the result (see

Marcuello(2) Col.3 lines 2-9),

c.   A speculative thread that is configured to speculatively execute subsequent code

within the program using the predicted result (see Marcuello(2) Col.3 lines 2-9

and Col.6 lines 14-20), wherein the subsequent code follows the section of code

in an execution stream of the program (see Marcuello(2) Col.5 lines 26-29),

d.   A determination mechanism that is configured to determine during every write

operation if a difference between the predicted result and the result generated by

the head thread affected execution of the speculative thread (see Marcuello(2)

Col.4 lines 53-57 and Col.7 line 16 – Col.8 line16). Here, the NW field is

updated, and subsequently checked, on every write operation to see if it has

reached a value of zero, which happens when the difference between the predicted

result and the head thread's result affected the speculative thread (see

Marcuello(2) Col.7 line 48 – Col.8 line6).

e.   A joining mechanism that is configured to merge state associated with the

speculative thread with state associated with the head thread if the difference did

not affect execution of the speculative thread (see Marcuello(2) Col.4 line 53 –

Col.5 line 5 and Col.5 lines 26-35), wherein the joining mechanism is configured

to:

I.   Merge the space-time dimensioned version of the memory element into

the primary version of the memory element (see Marcuello(2) Col.5 lines

2-5),

II.   Discard the space-time dimensioned version of the memory element (see

Marcuello(2) Col.8 lines 31-46),

f.   A mechanism that performs write operations for the head thread, the mechanism

being configured to:

I.   Perform a write operation to a primary version of a memory element (see

Col.7 line 48 – Col.8 line 16),

II.   Check status information associated with the memory element to

determine if the memory element has been read by the speculative thread

(see Col.7 line 48 – Col.8 line 16),

III.   Cause the speculative thread to roll back so that the speculative thread can

read a result of the write operation if the memory element has been read

by the speculative thread (see Col.8 lines 7-11),

      IV.   Perform the write operation to space-time dimensioned version of the memory element if the space-time dimensioned version exists and if the memory element has not been read by the speculative thread (see Col.4 line 53 – Col.5 line 9 and Col.7 line 48 – Col.8 line 16),

      g.   Wherein if the difference affected execution of the speculative thread, the apparatus is configured to execute the subsequent code again using the result generated by the head thread (see Marcuello(2) Col.8 lines 7-11).

8.   Here, the Applicant has described the above as the problem of a memory element having been read by the speculative result when it should have first been written by the head thread, causing erroneous results, and consequently either rolling back the speculative thread so it can be re-executed if there was a problem, or committing the thread if there was no problem (p.10 lines 3-23 of the specification). Marcuello has taught the comparing of the results of the head thread and the speculative thread, and either rolling back the speculative thread to be re-executed if the results were not equal (see Marcuello(2) Col.8 lines 7-11), or committing the thread if the results were the same (see Marcuello(2) Col.4 lines 53-57). Thus, Marcuello is operating in the same manner as the claim language has stated, in that if the speculative thread incorrectly reads the result of a write operation, it would produce erroneous results that would be detected in the thread comparison of Marcuello and consequently perform the proper action.

9.   Claims 1 and 23 are nearly identical to claim 12. Claim 1 differs in its lack of an apparatus to perform its method upon, but encompasses the same scope as claim 12. Claim 23 differs in it claiming a computer-readable storage medium storing instructions that when executed by a computer cause the computer to perform a method, which is taught by Marcuello

(see Marcuello(1) "ICache" of Fig.1), but the method encompasses the same scope as claim 12.

Therefore, claims 1 and 23 are rejected for the same reasons as claim 12.

10.   Regarding claims 2, 13 and 24, taking claim 13 as exemplary, Marcuello has taught the

apparatus of claim 12, wherein while executing the subsequent code again, the apparatus is

configured to perform a rollback operation for the speculative thread to undo actions performed

by the speculative thread (see Marcuello(2) Col.8 lines 7-11).

11.   Claims 2 and 24 are nearly identical to claim 13. They differ in their parent claims, but

encompass the same scopes. Therefore, claims 2 and 24 are rejected for the same reasons as

claim 13.

12.   Regarding claims 3 and 14, taking claim 14 as exemplary, Marcuello has taught the

apparatus of claim 12, wherein the determination mechanism is configured to determine if the

speculative thread accessed the predicted result. Here, the Applicant has described the above as

the problem of a memory element having been read by the speculative result when it should have

first been written by the head thread, causing erroneous results, and consequently either rolling

back the speculative thread so it can be re-executed if there was a problem, or committing the

thread if there was no problem (p.10 lines 3-23 of the specification). Marcuello has taught the

comparing of the results of the head thread and the speculative thread, and either rolling back the

speculative thread to be re-executed if the results were not equal (see Marcuello(2) Col.8 lines 7-

11), or committing the thread if the results were the same (see Marcuello(2) Col.4 lines 53-57).

Thus, Marcuello is operating in the same manner as the claim language has stated, in that if the

speculative thread incorrectly reads the result of a write operation, it would produce erroneous

results that would be detected in the thread comparison of Marcuello and consequently perform the proper action.

13.   Claim 3 is nearly identical to claim 14, differing in its parent claim, but encompassing the same scope. Therefore, claim 3 is rejected for the same reasons as claim 14.

14.   Regarding claims 4 and 15, taking claim 15 as exemplary, Marcuello has taught the apparatus of claim 12, wherein the determination mechanism is configured to determine if the predicted result differs from the result generated by the head thread (see Marcuello(2) Col.4 lines 53-57).

15.   Claim 4 is nearly identical to claim 15, differing in its parent claim, but encompassing the same scope. Therefore, claim 4 is rejected for the same reasons as claim 15.

16.   Regarding claims 5 and 16, taking claim 16 as exemplary, Marcuello has taught the apparatus of claim 12, wherein the prediction mechanism is configured to generate the predicted result by looking up a value based upon a program counter for the program (see Marcuello(1) Col.7 lines 14-20).

17.   Claim 5 is nearly identical to claim 16, differing in its parent claim, but encompassing the same scope. Therefore, claim 5 is rejected for the same reasons as claim 16.

18.   Regarding claims 6 and 17, taking claim 17 as exemplary, Marcuello has taught the apparatus of claim 16, wherein the prediction mechanism is configured to generate the predicted result by additionally looking up the value based upon at least one previously generated value for the result (see Marcuello(1) Col.5 lines 22-38).

19.   Claim 6 is nearly identical to claim 17, differing in its parent claim, but encompassing the same scope. Therefore, claim 6 is rejected for the same reasons as claim 17.

20.   Regarding claims 7 and 18, taking claim 18 as exemplary, Marcuello has taught the apparatus of claim 16, wherein the prediction mechanism is configured to generate the predicted result by performing a function on the value (see Marcuello(1) Col.5 lines 28-31).

21.   Claim 7 is nearly identical to claim 18, differing in its parent claim, but encompassing the same scope. Therefore, claim 7 is rejected for the same reasons as claim 18.

22.   Regarding claims 8 and 19, taking claim 19 as exemplary, Marcuello has taught the apparatus of claim 12, wherein the section of code includes one of a method, a function and a procedure (see Marcuello(1) Col.3 lines 24-33).

23.   Claim 8 is nearly identical to claim 19, differing in its parent claim, but encompassing the same scope. Therefore, claim 8 is rejected for the same reasons as claim 19.

24.   Regarding claims 9 and 20, taking claim 20 as exemplary, Marcuello has taught the apparatus of claim 12, wherein the section of code is a body of a loop in the program, and the result is a loop carried dependency for the loop (see Marcuello(1) Col.4 line 37 – Col.5 line 7).

25.   Claim 9 is nearly identical to claim 20, differing in its parent claim, but encompassing the same scope. Therefore, claim 9 is rejected for the same reasons as claim 20.

Response to Arguments

26.   Applicant's arguments filed 7/29/04 have been fully considered but they are not persuasive.

27.   On p.9 of the amendment filed 7/29/04, the Applicant argues with respect to claims 1/12 and 23, in essence:

> *"Applicant respectfully points out that Marcuello(2) teaches comparing the final results*
>
> *of the head thread and the speculative thread and either rolling back the speculative*
>
> *thread or committing the speculative thread, depending on the result of the comparison.*
>
> *Specifically, Marcuello (2) states: "When a speculative thread reaches the closing*
>
> *branch of its iteration, it is suspended and waits to be either committed or squashed."*
>
> *(see Marcuello (2), p.79, section 2.1, third paragraph, lines 4-6). In contrast, the present*
>
> *invention is directed to monitoring every write operation from the head thread to*
>
> *determine if the speculative thread has read the value and, if so, immediately rolling back*
>
> *the speculative thread to reread the new value."*

28.   However, the Applicant's interpretation of the prior art of record is incorrect and the

citation used is taken out of context. The citation the Applicant references in Marcuello(2)

actually refers only to the situation where speculative threads are being initialized, and does not

relate to the normal operating conditions of Marcuello(2). Instead, as taught above (see

paragraphs 7-9 above), Marcuello has taught monitoring every write operation to determine if the

speculative thread has read the value and if so, rolling back the speculative thread to reread the

new value (see Marcuello(2) Col.4 lines 53-57 and Col.7 line 16 – Col.8 line16). As described

above, the NW field is updated, and subsequently checked, on every write operation to see if it

has reached a value of zero, which happens when the difference between the predicted result and

the head thread's result affected the speculative thread (see Marcuello(2) Col.7 line 48 – Col.8

line6). Thus, on every write operation a determination is made whether the situation has

occurred that the speculative thread read a value different than the predicted value and would

need to be rolled back and re-executed.

29.   Furthermore, in response to applicant's argument that the references fail to show certain

features of applicant's invention, it is noted that the features upon which applicant relies (i.e.,

immediately rolling back the speculative thread) are not recited in the rejected claim(s).

Although the claims are interpreted in light of the specification, limitations from the specification

are not read into the claims. See *In re Van Geuns*, 988 F.2d 1181, 26 USPQ2d 1057 (Fed. Cir.

1993).

Conclusion

30.   The prior art made of record and not relied upon is considered pertinent to applicant's

disclosure. Applicant is reminded that in amending in response to a rejection of claims, the

patentable novelty must be clearly shown in view of the state of the art disclosed by the

references cited and the objections made. Applicant must also show how the amendments avoid

such references and objections. See 37 CFR § 1.111(c).

31.   Any inquiry concerning this communication or earlier communications from the

examiner should be directed to Barry J. O'Brien whose telephone number is (703) 305-5864.

After October 12th, 2004, the examiner can be reached at (571) 272-4171. The examiner can

normally be reached on Mon.-Fri. 6:30am-4:00pm, with the exception of first Friday of every bi-
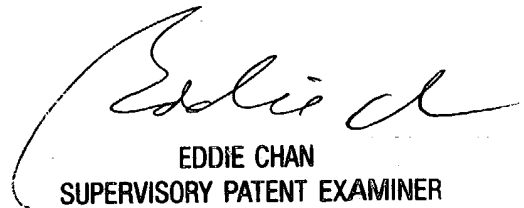
week.

       If attempts to reach the examiner by telephone are unsuccessful, the examiner's

supervisor, Eddie Chan can be reached at (703) 305-9712, or at (571) 272-4162 on or after

October 12th, 2004. The fax phone number for the organization where this application or

proceeding is assigned is 703-872-9306.

32.   Information regarding the status of an application may be obtained from the Patent

Application Information Retrieval (PAIR) system. Status information for published applications

may be obtained from either Private PAIR or Public PAIR. Status information for unpublished

applications is available through Private PAIR only. For more information about the PAIR

system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private

PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

                              Barry J. O'Brien
                              Examiner
                              Art Unit 2183

BJO
9/15/2004

EDDIE CHAN
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 2100